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Fire Management Notes

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An international quarterly periodical devoted to forest fire management.

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Contents

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Cover: Firefighters using hand tools on Hanover fire line, 20 miles northeast of Riggins, ID, August 1967.

Elko Interagency Dispatch Center

Bonnie Whalen

Fire dispatcher, Humboldt National Forest, Elko, NV

The northeastern corner of Nevada has three wildland fire protection agencies: the Elko District of the Bureau of Land Management (BLM), Humboldt National Forest and the Northern Region of the Nevada Division of Forestry (NDF). In the past as each of these agencies dispatched equipment and personnel, sister agencies were unaware of the circumstances and area resources were not used in the most cost-effective manner. Many times resources were brought in from as far away as Alaska or North Carolina when there were local resources available and willing to support an incident.

In the late 1970's the National Forests in Nevada started contracting some fire protection services from the Nevada Division of Forestry. Part of the agreement negotiated with the State called for the dispatching to be handled by the Humboldt National Forest during fire season, and thus the first interagency dispatch center was formed. Several years later negotiations were started with the Elko District Bureau of Land Management to make it a tri-agency dispatch center. ry. BLM was in the midst of planning the construction of a new compound on the east side of Elko. They designed the facility to accommodate the dispatch center as part of the complex.

Early in 1985 Doug Waggoner, BLM dispatcher, Bonnie Whalen, Forest Service dispatcher, Mike McCarty, NDF fire protection officer, and Fred Parry, BLM fire management officer, made a 1-day trip in the Nevada Division of Forestry plane to several interagency dispatch centers to get some ideas for establishing an effective interagency center. After discussing many of the pros and cons of the management styles at each of these centers it was decided that the Elko Center would strive to be fully integrated. Each person working in the center would be completely competent to handle every aspect of all the agencies' dispatching needs. Each function of the center would perform at the highest level needed by a single agency. For instance, because the Humboldt National Forest demanded a 20-minute check-in for flight-following, all three agencies would do a 20-minute flight-following.

The Elko Interagency Dispatch Center, ready for action.

The first task the planning committee set out to accomplish was the development of an interagency report of incident form that would be functional for all three agencies. This was completed and presented with the first operating plan for approval. We have since set our sights on developing other forms that would be used for all agencies. We are continuing in our efforts to integrate all the agency needs onto one form wherever we are duplicating efforts. This year we have developed a field fire report to be carried by each local engine foreman and

crew boss. This report incorporates the information each agency needs to do its individual fire reports.

In the early spring of 1985 a formal operating plan was signed by B. J. Graves, Humboldt National Forest Supervisor; Rod Harris, Elko BLM District Manager; and John Ross, Northern Region NDF.

Three radio consoles with all agency frequencies were installed. They were rearranged several times before reaching the present configuration. When it was determined this arrangement was going to work well a permanent cabinet was designed and built to house the consoles. The paging system that ties together the volunteer fire departments was also in place and ready to use.

Maps were framed and hung on the walls. The response areas as related to a preplanned dispatch system were outlined and numbered. Each of these areas used the closest forces concept where all available resources for response were considered. Preplanned dispatch cards were made up and color coded to the areas on the maps. Each of these run cards shows a cross section of agency resources.

In 1986 the Humboldt National Forest completed a fire action plan, and Confine, Contain, Control Strategies were plotted on the maps and tied into run cards.

The Nevada Division of Forestry has responsibilities for structure and vehicle fire, emergency medical situations, and chemical spills, in addition to the wildland fire responsibilities that the other agencies have. Response to the various types of incidents is spelled out on the run cards. Twenty-seven volunteer fire departments form the backbone of the NDF network. All of these volunteer fire departments have structure fire suppression training; they all roll on wildland fires as first responders in their respective areas.

The Center is designed so that one dispatcher can handle all agencies' routine traffic from one console. A duty dispatcher is assigned this responsibility as part of scheduling strategy. In the case of an influx of emergency traffic another dispatcher will activate the second console. The third console will be brought into play for complex situations. This third console will usually be used for aircraft, taking the flight-following responsibility from the other two consoles and ensuring that aircraft are properly tracked.

During the 2 years the Interagency Dispatch Center has been in operation, the resources available to the center have increased significantly. The State of Nevada has built a number of Honor Camps as part of their prison system. Three of these institutions have been built in northeastern Nevada with a fourth being planned. Each Honor Camp has 10 conservation crews that are tracked through the center. These crews are used as conservation crews doing many kinds of projects in the areas. During emergencies the crews are activated as hand crews to respond to incidents. This is particularly the case in fires although the crews have also been used in flooding situations and on train wrecks.

Nevada has a history of close working relations among the major wildland protection agencies. The Elko Interagency Dispatch Center is a prime example of that continuing cooperation. ■

The National Wildfire Coordinating Group—Then and Now

Jack Wilson and Jerry L. Monesmith

Respectively, Director, Boise Interagency Fire Center, USDI Bureau of Land Management, Boise, ID, and safety and training officer, USDA Forest Service, Washington, DC

The National Wildfire Coordinating Group (NWCG) is made up of the USDA Forest Service; four Department of the Interior agencies—Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Fish and Wildlife Services (FWS); and State forestry agencies through the National Association of State Foresters. The purpose of NWCG is to coordinate programs of the participating wildfire management agencies so as to avoid wasteful duplication and to provide a means of constructively working together. Its goal is to provide more effective execution of each agency's fire management program. The group provides a formalized system to agree upon standards of training, equipment, qualifications, and other operational functions.

The Need for Cooperation

Just as the fires of the 1960's led to the formation of the Boise Interagency Fire Center (BIFC), so did the fires of the early 1970's (1970, 1971, and 1973) stimulate the formation of the National Wildfire Coordinating Group. Some suggest the beginning was a famous river trip down the Colorado by then Secretary of Agriculture Earl Butz and Interior Secretary Rogers Morton where the two leaders agreed, after several discussions around the campfire, that their agencies should cooperate more. But, the need for a coordinating mechanism had been recognized long before this trip. Two events had a strong influence in focusing this need: (1) the "America Burning" Task Force Report, which strongly urged a single national firefighting concept and (2) the entry into the fire program by the aerospace industry.

A third reason was the recognition of escalating firefighting costs. Closer to home, and an event many can relate to, was a meeting of a group of wildland fire training officers at Boise in late 1972 where it was pointed out that eight distinct units were developing courses in fire safety. These officers were appalled at the duplication of effort and formed their own training committee to cope with the situation. This committee was the predecessor of the NWCG Training Working Team.

Formation

Under the leadership of Henry W. DeBruin, Director of Aviation and Fire Management, USDA Forest Service, and James H. Richardson, Chief, Division of Fire Management, USDI Bureau of Land Management, a meeting was convened in January 1973, in the auditorium of the USDI. There were four representatives from USDA—Hank DeBruin, A&FM; Craig Chandler, Division of Fire and Atmospheric Sciences Research; Williard Tikkala, Cooperative Fire Protection; and Robert Bjornsen, BIFC—and five from USDI—J.H. Richardson, Chief, Division of Fire Management, BLM; Jack F. Wilson, BLM/BIFC; Roger Gettings, Resource Management Staff (Park Opus) NPS; James Hubert, Refuge Management staff, FWS; and Richard Ely, Forester, BIA. This meeting followed President Nixon's actions in response to the oil embargo, and the room was cold and poorly lighted. The meeting started in a very stiff, formal, wait-and-see manner.

But the pressing need and general agreement to agree led to the development of a coordination system, and thus NWCG was formed. A lot of time was spent deciding on the name as each word was to have a specific meaning: "National" to clearly set forth the scope of the effort, "Wildfire" to ensure the structure and urban fire missions were delineated, "Coordinating" to emphasize the cooperative nature of coordinating together, and "Group" because of the tenuous working relationships of the people involved.

As a point of interest, the founders of NWCG were unaware that a similar organization, chaired by William Greeley of the Forest Service, had existed between 1927 and 1933. This organization was known as the Forest Protection Board, and

its charter read almost the same as NWCG's. It differed from NWCG in that it was headed by line officers.

Two of the major first actions of NWCG were to promulgate a charter and to add a representative from the National Association of State Foresters (NASF). The State Forester tapped by NASF was the chairman of their Fire Committee, Ralph Winkworth of North Carolina. He was a strong line officer and past president of NASF. Two years later a second State Forester, Gareth Moon of Montana, was added. The NWCG charter, which set forth the organization's purpose and functions, was signed by Secretary of Agriculture Earl Butz and Secretary of Interior Tom Kleppe in February 1976.

Functions

The people who originally made up the group were then, and are today, basically staff leaders in agency programs. They are not line officers. However, don't underestimate the power of the group, because in most cases these leaders are the people who have a large influence on the policy and funding of an agency program. Agreed-upon policies, standards, and procedures are implemented directly through regular agency channels.

The NWCG elected to operate through "working teams," a rather nondescript term that doesn't do justice to a tremendous effort. The working team concept has had the greatest effect of NWCG in that it has provided a means for the exchange of knowledge about all dimensions of fire management.

Originally there were 12 working teams. The criteria established required that they be small (8-10 persons), interagency in nature, and insofar as possible balanced geographically. Teams could appoint subteams, and several of these subteams have been very productive, for example, the National Fire Equipment Standards (NFES) Team and the Fire Prevention Task Team that developed the "cool sheet" and standardized fire reporting. Over the years some teams have been abolished, some put on an "as needed basis," and some retained.

The current teams are:

- Training Working Team
- Incident Command System Working Team
- Prescribed Fire and Fire Effects Working Team
- Fire Equipment Working Team
- Wildfire Prevention Working Team
- Publication Management System Unit

A member of NWCG serves as a representative on each working team and carries working team recommendations back to the parent body. Occasionally a committee of specialists is formed, for a short term, to complete specific tasks. Examples are the Fireline Safety and Wildland/Urban Interface committees.

In addition, an executive secretary serves on the group to maintain status of the members, track NWCG issues, solicit input, prepare meeting agendas, provide advance study materials, prepare budget plans, and oversee preparation and distribution of minutes.

There are several avenues in which individuals or agencies can interface with the NWCG to retrieve information, make recommendations, or raise issues. Contact can be made with agency representatives on the parent group and/or the working teams, the group or working team chairpersons, or the executive secretary.

If contact with the field is needed, the working team chairperson will contact the agency NWCG member as a courtesy and for authorization and coordination purposes. Working teams needing information from States request this information from one or both of the NASF representatives of NWCG.

Accomplishments

NWCG has accomplished a number of major goals with the assistance of working teams and other task groups.

1. Development of interagency fire training programs; State and Federal fire personnel have the same training and qualifications.

2. Development of fire chemical standards to reduce environmental impact and increase cost effectiveness.

3. Implementation of the National Interagency Incident Management System (NIIMS) including a common on-incident organizational management system, a National Interagency Wildland Fire Qualifications Guide, associated training, and supporting technologies.

4. Standardization of Federal air tanker and helicopter contracts.

5. Standardization of radio frequency agreement format for sharing specific radio frequencies at the local level.

6. Development of fire prevention training materials and guides.

7. Standardization of fire cache equipment leading to equipment compatibility and use by all fire organizations.

Future

What's the future of NWCG? Will it last? We certainly think so. First, the concept is an important

one—the concept that all of us in the wildland fire business need to share information in a formal way and that a form of high-level coordination is effective and beneficial.

None of us can go it alone. Over the years interagency cooperation has vacillated between two competing philosophies; autonomy and fragmentation on the one hand and cooperation and synergism on the other. Program similarities and sheer cost dictate the potential benefits of the latter philosophy, and this overriding need for cooperation is the basis of the NWCG creed. The magic of NWCG, however, is that the agencies can maintain individual decisionmaking and autonomy on some issues, but agree upon a synergistic approach when it benefits everyone involved. ■

Creed of the National Wildfire Coordinating Group

- We believe the goal of effective wildfire management is best served through coordinating the resources of all fire management agencies, irrespective of land jurisdiction.
- We believe in the concepts of full partnership, trust, and mutual assistance among the fire management agencies.
- We strongly support professionalism in all facets of fire management.
- We strive to bring the best talent to bear on vital issues in a timely manner, irrespective of agency affiliation.
- We strive for economy, efficiency, and quality in all activities, and practice concepts of total mobility, closest forces, and shared resources without geographic limitations.
- We constantly search for areas of agreement to further the effectiveness of the wildfire management program.

NWCG Fire Prevention Team

The National Wildfire Coordinating Group's Fire Prevention Working Team is focusing its attention on issues identified in the Report of the National Wildland/Urban Fire Protection Conference held in Denver, CO, in September 1986. One major program will be to develop stronger working relationships with other national fire protection organizations such as the National Fire Protection Association and the U.S. Fire Administration.

Through increased cooperation the team will be able to guide the development of improved fire prevention training, the development of new national standards for building and development in interface areas, and be able to provide better assistance to the wildfire protection community. At the team's 1987 spring meeting a proposal was approved to begin work with NFPA to produce a comprehensive Wildland/Urban Fire Protection Handbook for use by wildland and urban fire agencies responsible for developing interface fire programs.

The handbook will include information on assessing wildland and urban fire risks, development of protection program alternatives, economic considerations, fire engineering specifications, fire education programs, training, incident management, and other subjects important to successful fire protection programs. Target date for publication is June 1988.

The working team is chaired by Art Creelman, Pennsylvania Bureau of Forestry, Harrisburg, PA, and includes representatives from the Federal wildfire agencies and representatives from several State forestry agencies.

John Marker

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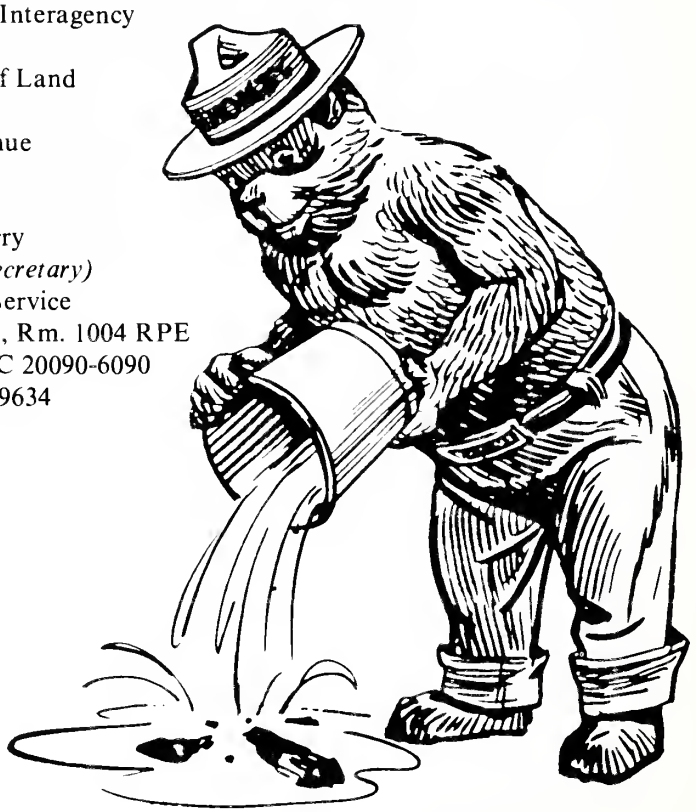

Prescribed Fire in Blueberry Management[1]

Edward W. Kautz

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Wildland managers need to understand the role of prescribed fire and how to apply it to blueberry management. Prescribed fire is an important tool in the management of blueberry plants that dates back to use by Native Americans. Management of the blueberry resource on Eastern Region National Forests managed by USDA Forest Service has recently been given renewed emphasis. Forest visitors spend many hours gathering blueberries, especially in the northern National Forests. The abundance of blueberries has generally been left to nature. However, human interference with nature through decades of fire control that limited the size of natural fires has had an effect. Prescribed fire on a few National Forests has occasionally benefited blueberries as a side effect from burns for other resource management objectives. Some good production sites have been developed from these burns.

In one incident, after a prescribed fire to improve sharptail grouse habitat on the Hiawatha National Forest, in the Upper Peninsula of Michigan, a magnificent field of white and pink flowers bloomed the spring after the burn. After investigation, it was found that the prescribed fire had rejuvenated a decadent blueberry field. In Pennsylvania, along a trail to Hawk Mountain a timber stand was partially removed to make visual lookouts for hikers. The next spring the area was covered with blueberry flowers *(2)*.

History

Chronicles by early English settlers indicate that in the 1600's Native Americans were seen gathering and drying blueberries in New England. Reports from the mid-1600's indicated cases where Native Americans were drying and selling blueberries to the English settlers by the bushel. Henry Schoolcroft noted in 1831 that "natives were seen drying blueberries along the Namakagon River in Wisconsin." During this same period, Joseph Nicollet found blueberries during his travels through the Mississippi River headwaters. He also saw Native Americans drying blueberries for winter use *(4)*.

Though harvested in the wild for many centuries, it is only recently that blueberries have been domesticated. Elizabeth White and F.V. Coleville, a USDA employee, grew the first blueberries for home production from stock of the High Bush variety off the Barrens of New Jersey in the early 1900's. Blueberries can be found today in all States east of a line extending from Minnesota to Texas and in the Pacific Northwest *(2)*. Blueberries are known locally by many names, such as whortleberry, hurtleberry, whinberry, trackelberry, tangleberry, bilberry, and many more. It was not until the mid-1960's that the Low Bush species was domesticated. However, the Low Bush varieties are hard to domesticate, and horticulturalists have had problems. The wild low-bush blueberry fields of Maine reportedly produced over 40 million pounds of commercial blueberries in 1980 *(4)*.

Minnesota wild blueberry fields were considered for commercial use in the early 1900's. However, the test plot research was hampered by adverse weather conditions, and the project was dropped *(4)*. Presently, thousands of visitor-days are spent annually picking berries on the National Forests. Some people use their vacations to pick blueberries, which they sell for as much as $6 per gallon at roadside stands. Visitor surveys in northern Minnesota have indicated that in the 1970's, 20 percent of recreational visitors' time in the National Forest was spent picking berries. A survey in 1980 at Ely, MN, and along the North Shore of Lake Superior, indicated that visitors spent 30 percent of their time picking berries *(4)*. The time spent varied with the conditions and abundance of the crop.

Management of the Resource

Forest managers on the Green Mountain National Forest in Vermont, the Hiawatha National Forest in Michigan, and the Superior National Forest in Minnesota, have ignited prescribed fires specifically to aid blueberry culture. They have also benefited blueberry production by using prescribed fire for other resources. From this background information, and data available from the commercial fields of Maine, it is apparent that the blueberry resource of the Lake States can be increased through the use of prescribed fire. The educational opportunities for showing the

[1]Reprinted from Proceedings of Symposium on Prescribed Burning in the Midwest: State of the Art, held at Stevens Point, WI, March 3-6, 1986.

Visitors spend thousands of visitor-days picking blueberries on our national forests.

public the benefits of a good prescribed fire program are unlimited.

Ecologically, blueberry fields are temporary stages in the natural succession from treeless burns to climax forests *(3)*. Without fire, the blueberries are gradually crowded out by invading brush and trees. Natural blueberry fields used to be perpetuated by natural fires and Native American burning. If a site selected for blueberry production already has berry plants available, it is best to determine the relative age of the plants. Younger, healthy plants are easier to regenerate than old, decadent plants. If the site does not have plants readily available, investigation must be made to determine if the area might ever have had plants. If the site is acceptable, but without sufficient plants, it is possible to consider the use of volunteer personnel to plant the area with berry plants from other prosperous areas on the Forest.

Blueberries need open, nonshaded areas to grow in. They can grow on almost any soil that has enough organic matter. The plants need a pH of 4.8 ideally, but a range from 4.2 to 5.3 is usually acceptable. Indicator species for good high-bush blueberry growth are azaleas, rhododendrons, and holly *(2)*. Low-bush blueberries will grow in most acidic soils that have enough winter snows to protect the plant rhizomes from the cold. Moisture and composition conditions influence plant regeneration after fires. The plants need well-drained soils, 18 to 20 inches deep, with a high water table that will help them through summer drought periods.

Oak and pine soils are normally acidic and thus indicators of possible blueberry fields. In the Lake States area, open rocky uplands and sandy barrens, which are normlly poor growing sites, are possible blueberry sites. Jack pine areas have high potential for becoming blueberry fields during regeneration periods, if prescribed fire is used for site regeneration *(1)*. Red pine stands on some areas may also be good blueberry field candidates.

The Role of Prescribed Fire

For hundreds of years Native Americans have burned blueberry fields. For decades the commercial harvesters of the wild blueberry fields in Maine burned blueberry fields. All indications are that burning is better than mechanical pruning. Experience has indicated that reapplication of fire can be performed on a 2- to 3-year cycle in the Lake States area. The first year after a prescribed fire, there is usually no crop, the second year is usually a bountiful crop, the third and fourth years are gradually less, and the fifth year is generally poor. There is some concern that repetitive fires will ruin the crop or the soil, but this has not been substantiated by repeated burning in commercial blueberry fields. The key element is the timing of the burn.

The challenges confronting a prescribed fire manager in blueberry burning are:

- Unavailability of the right weather conditions to burn.

- Accidentally hot burns that remove too much soil, allowing the rhizomes to suffer from summer heat.
- Killing of the rhizomes.
- The ability to time the wildfield burning before the plant growth starts.

The advantages of blueberry burning are:

- Release of a nitrogen flush after burning.
- Removal of some insulation cover of the soil to allow early spring soil warming.
- Change in soil color to help increase early spring soil temperatures needed for good plant growth.
- Nitrogen release from certain bacteria that are found in ash after a fire.
- Better than mowing or hand pruning.
- Stimulates the proliferation of stem growth.

It is important to note that rhizomatous plants bear fruit on the *new* woody growth. That is why burning is important to blueberry management.

Burning Prescription Guidelines

Suggested prescribed fire prescription guidelines a manager needs to consider are:

- Start a Public Information Plan at least 1 year in advance: you may inadvertently plan to burn someone's favorite picking site. Inform the public of the benefits from the prescribed fire ahead of time, being sure to point out the Native American lore associated with burning.
- Spring burns are preferred, generally in early April prior to plant growth. However, a fall burn is better than no burn for blueberry management.
- Frozen soil with no snow cover is ideal.
- If the soil is not frozen, dampness is preferred in clay soils, dryness in sandy soils.
- A warm, dry, clear sunny day is desirable.
- Early afternoon ignition time is best.
- Wind is required, preferably 5 to 10 miles per hour.
- Fuel is needed to carry fire, usually an accumulation for 4 or 5 years since a previous burn.
- Fast moving fire front to burn only the above-ground parts of plants.
- Don't plan for total kill or total burn area.
- Head fire with heat is preferred over backing fire with longer residual fire.
- Unit prescription should be for south and southwest slopes or no slope areas—don't worry about north and east slopes if they don't burn.
- Supportive ignition will normally be needed to keep fire burning.
- Plan to rotate areas of prescribed fire over a 4- to 5-year period. Don't burn all of the area at once.

Prescribed burning of blueberry patches increases the yield of berries.

Monitoring

Monitoring the results of a prescribed fire is a very important step in burning programs. Blueberry management requires some monitoring items not usually required for other programs. Blueberry

growth and production require certain weather conditions after the burn to produce a bountiful crop. Failure to monitor these conditions could cause negative production to be blamed on the prescribed fire. These conditions that need to be monitored are:

- Snow depth. Lack of snow depth could freeze kill the plants.
- Last killing frost. Late frosts kill flower buds, and no berries form.
- Bees. Lack of bees to pollinate flowers means no berries. Consider the use of a special beekeeper for the area.
- Insufficient moisture. Plants require moisture in spring and summer months.
- Excessive moisture. Too much moisture retards growth.

Summary

The natural abundance of blueberries in America was maintained and stimulated by natural fires and those set by Native Americans. After centuries of human invasion into the wildlands and decades of fire control activities, the role of fire in blueberry production has been greatly curtailed. Wild blueberry production has gradually diminished in the United States. As wildland managers, we have an opportunity to rejuvenate the declining blueberry fields through appropriate application of prescribed fire. Recreational berry picking can be greatly enhanced by correct timing and location of prescribed fire in the Lake States area and in other areas suitable for blueberry plants. Good burning and good picking!

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Thirteen Situations that Shout "Watch Out!"

1. You are building line downhill toward a fire.
2. You are fighting fire on a hillside where rolling material can ignite fuel below you.
3. You notice the wind begins to blow, increase, or change direction.
4. You feel the weather getting hotter and drier.
5. You are on a line in heavy cover with unburned fuel between you and the fire.
6. You are away from burned area where terrain and/or cover makes travel difficult and slow.
7. You are in country you have not seen in the daylight.
8. You are in an area where you are unfamiliar with local factors influencing fire behavior.
9. You are attempting a frontal attack on a fire with mechanized equipment.
10. You are getting frequent spot fires over your line.
11. You cannot see the main fire and you are not in communication with anyone who can.
12. You have been given an assignment or instructions not clear to you.
13. You feel like taking a little nap near the fire line.

TCard: New Resource Tracking Software

Dave Stewart

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In the 1980's heavy fire activity has combined with staffing reductions to make large manpower mobilizations of personnel a fact of life for fire managers. In 1986 the Bureau of Land Management Alaska Fire Service (AFS) began trial use of a microcomputer running commercial database software to track personnel and their qualifications on a real-time basis. Managers anticipated cost savings through careful matching of qualified local personnel to field assignments. Some of the problems identified in this trial were:

1. Commercial database software is not suited for entering and accessing individuals' Incident Command System (ICS) qualifications.
2. Tracking several kinds of resources (individuals, crews, etc.) is difficult with commercial software.
3. Resource tracking software must be very easy to use to be viable in a fire-bust situation.

A resource tracking program called TCard was developed to address these problems. A prototype version (0.6) is available for examination.

Description

TCard runs on the Macintosh Plus and Macintosh 512E computers. It prints on the Apple Imagewriter and Laserwriter printers.

TCard presents users with on-screen replicas of a standard "card sort" tracking system. Many card sorts can coexist simultaneously on screen, giving the user ready access to a practically unlimited number of empty slots. Resource cards for individuals, crews, aircraft, and fires are created on screen. Cards can be edited, examined, rearranged, moved from one sort to another, duplicated, or destroyed at any time. Sorts can be displayed in a variety of fonts and font sizes. In most respects a sort on screen behaves like a real wall-mounted card sort, making TCard very easy to use.

Extensive use of screen graphics and the "mouse" greatly reduce the typing needed to fill out resource cards. Text information can be typed into labeled fields on each card and edited using simple cut-and-paste techniques. Friendly on-screen warnings make loss of data through user error very unlikely.

Any card sort can be saved on disk for later examination or updating. When a sort is saved both the contents and arrangement of its cards are preserved. Frequently used cards and sorts can be created once and stored in a disk file for repeated use. Such disk files can easily be duplicated for archival purposes.

Data Capacity

TCard's capacity depends on the size of the computer's memory. With one megabyte of memory over 730 cards can be on screen at one time, the actual number depending on how many separate card sorts are on screen and other factors. In practice it is difficult to work with more than 6 to 10 sorts on screen at a time because the screen becomes too cluttered. Each sort has 256 slots arranged in 16 columns and rows. TCard disk files are compact. A large fire's sort might use about 5 kilobytes of an 800-kilobyte floppy disk.

TCard provides four capabilities not available with a wall-mounted card rack. The most powerful is the ability to search for cards containing desired information, such as a specific set of ICS qualifications or a certain name. Cards meeting the criteria are counted and visually highlighted on the screen for easy location. A typical search might inspect over 500 cards and take about 5 seconds to complete. Ordered lists of resources can be created from any sort. Lists can reflect the results of a prior search, making it easy, for example, to list all the individuals having a certain ICS qualification.

A sort or a list can be printed as it appears on screen. Printing can be done on several sizes of paper in draft, near-letter, or (with a laser printer) letter quality.

TCard can automatically count and summarize by type the individuals and crews on each sort. A number of these summaries can be quickly combined in a list to give an overall personnel summary for the fires in an agency's jurisdiction.

Advantages and Disadvantages

TCard presents several advantages over off-the-shelf database software or wall-mounted card racks. It is easier to use than general database software because it is designed specifically for tracking fire suppression resources. Entry of qualifications data, especially, is much easier using TCard. Re-

sources displayed on screen as a standard card sort rather than in a list format are more intuitive and easy to work with for experienced dispatchers. Searching quickly for needed resources is impossible with a wall-mounted card rack. Archiving each day's card sort or listing its contents isn't practical with real cards, but is easy with TCard.

On the other hand, with programs like TCard only one person at a time can manipulate a sort, and a sort can't be viewed by a large group unless it is printed first. An advantage of commercial software is that continued support and product development can be expected from an established software company.

Future Development

TCard 0.6 is a prototype only. Arbitrary decisions about card design, list formats, etc. were made by the programmer. Feedback from potential users is welcome and will dictate changes made in future versions. Individuals interested in doing development work on the TCard program can obtain the source code from the programmer.

The TCard program and its source code are public domain. The TCard program, user's guide, and the program source code can be obtained from:

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Forest Service Fire Policy in the Southwest

William L. Russell, Jr.

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USDA Forest Service, Southwestern Region, Albuquerque, NM

How is the Forest Service Southwestern Region doing in implementation of fire policy and successfully maintaining a proactive relationship with the news media? Without any hesitation, we can say that we have definitely made great strides in the last couple of years. Documentation of progress, however, is extremely difficult. Under the 10 a.m. policy, it was very easy to tell if a fire *control* organization was meeting its objective. All fires were suppressed at 10 acres or less before 10 a.m. of the day following ignition—or you were not successful. Under the appropriate suppression response mode of operation, however, evaluation of progress or success by a fire *management* organization is not so simple. We no longer have one simple approach or rule to be judged by—we have fire management, a complex art, with the entire American public being the art critics judging our work.

How does a change from *control* of fires to *management* of fires affect the way we do business, evaluate ourselves, and explain our actions to the media? The basic concept of fire management is difficult to explain because management must recognize that every fire is an individual, unique event that must be evaluated as a particular instant in time and space. Decisions made about how to manage the fire at initial ignition and/or reporting may not remain static. Fire managers must continue management of every fire from time of report until the time the fire is officially declared out. Prior to each additional burning period a fire continues, the fire manager must document a decision to either continue the previous day's appropriate suppression action, or change to a new action. This decision is based on professional judgment, which is a result of training and experience. The decision must be based on the current and predicted fire behavior, fuels present in the path of the fire spread, lives or resources threatened, natural or constructed barriers to the fire spread, and personnel available. At the same time, the fire manager must be aware of the fire activity in the entire Southwestern Region and throughout the Nation. The fire manager must integrate all of these variables into a decision that is always subject to 20/20 hindsight critique if something goes wrong, and seldom much praise if everything goes according to plan.

The news media are generally understanding and supportive of the fire policy when we take the time and effort to educate them Forest officers who have been aggressively proactive with their local media have found the experience not nearly as difficult as thought or feared. Some media personnel even push us to do more in the way of management (as they understand it) than we are prepared to do or than is desirable to do from an ecological point of view. Those not prepared to do more, correctly, need the push not only from the media, but from their peers in fire management as well. In cases of pushing to do something that would harm the resource, we must resist with clear, concise, professional reasoning.

How Can We Measure How We're Doing?

As we continue to increase implementation of the fire policy, we can probably expect an increase in total acres burned each year in relation to the total number of fires occurring. This acres burned figure has been used in the past as a red flag indicating damage done by wildfires. However, acres burned does not mean the same thing today as it did under the 10 a.m. policy. By managing a fire of low intensity, what may have been a spot fire under aggressive control actions following the 10 a.m. policy may now be kept under surveillance for several days and wind up burning several acres. A thousand-acre fire being managed under a low fire-intensity level is in no way comparable to a thousand-acre fire burning under a high intensity level and managed under a control mode. Therefore, we find that acres burned figures are difficult to compare. The total acres burned under a fire management mode of operation is a result of a complex interaction of numbers of starts, time, resources, and the judgment of individual fire managers. It is no longer a simple reflection of resources committed to numbers of starts, with aggressive action the only option available.

We are also confident that we are seeing significant reductions in emergency firefighting funds

expended each year. During the 1985 fire season, the Southwest Region had 11 fires in excess of 1,000 acres. Under the 10 a.m. policy, most of these would have had a class I or II fire team of 20 to 40 overhead personnel, plus other line support, associated aerial operations, and probably 200 or more crewmen assigned. All of this organization would spend 3 to 5 days on an average fire, including fairly extensive mop-up, spending from $30,000 to $50,000 or more per day. Eleven fires of this magnitude of control operations could easily have cost $3 million of emergency firefighting funds. In reality, we did not have a single class I or II team on any of these fires. Each fire probably cost an average of $2,000 rather than $50,000. This is a considerable savings of taxpayers' dollars.

The fire manager must face one danger in every decision concerning appropriate suppression response. That danger is that if an appropriate suppression action of less than full control is taken and does not work out as planned, the increasing fire size may begin to result in resource damage that indicates a control mode is appropriate. The resulting total suppression costs may exceed what might have been spent had the control mode been chosen as appropriate for the initial response. There have been and will always be such fires. Even under the 10 a.m. policy, with aggressive initial control actions, we "lost" many fires and had to spend big bucks to control them. With more experience and years of data to analyze, we may be able to compare emergency firefighting funds spent on nonproject (class I or II) fires and be able to compare the year-to-year progress of implementation of the fire policy. At this time there is an insufficient data base for such an analysis.

In the absence of such an analytical method, we are left with only the subjective view of long-time fire management specialists comparing "what we do" with "what we say we do." From that subjective analysis, we say again, "We are making progress. We still have much to do, but we are not standing still and are no longer operating under the 10 a.m. policy."

Conclusions

In the book "In Search of Excellence," authors Peters and Waterman indicated that a major change in policy in a large national corporation took an average of 7 years to finally become "standard company policy" (*1*). The National Fire Policy was revised in 1978-79. On the assumption that the Forest Service, as a large Federal agency, is probably as slow to implement a major change as an equivalent national corporation, we should expect that we would probably take at least the average 7 years to implement a major change in the fire policy. We are now into the ninth year of the revised policy. With 8 years of working to understand a new policy ourselves, implement at a steadily progressive pace, and attempting to explain our actions to the publics we serve, we are now rapidly turning the corner to the time when "appropriate suppression response" is considered the standard company policy in the Forest Service.

Literature Cited

1. Peters, Thomas J.; Waterman, Robert H., Jr. In Search of Excellence. New York: Warner Books; 1982. ■

Have You Received Your Forest Fire News?

Forest Fire News is the publication of the North American Forestry Commission and is now published twice a year. To get on the mailing list, please write:

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Hull, Quebec Canada K1A 1G5

Area Command—Developing and Implementing Strategic Goals and Policies During Emergency Situations

Troy Kurth

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The development of the strongest possible strategic goals and policies is the area commander's most difficult responsibility and highest priority.

The strategic decision model can provide the area commander with the necessary decision support to develop organizational structure, strategic goals, and policies for successful complex operations.

Experienced incident commanders may not require a strategic decision model in order to attain single incident objectives. As the complexity of operations and the scope of the situation increases, however, incident commanders require more than instinctive guidance for decision support.

The strategic decision model outlined in this paper was applied to the Enterprise unified area command established in northeastern Oregon, southeastern Washington, and southwestern Idaho (Hells Canyon) during August 1986.

The State of Oregon, Bureau of land Management, and the USDA Forest Service formed a unified area command at Enterprise, OR, to direct fire protection operations over all State and Federal lands within the area. The situation included an estimated 120 lightning-caused wildfires up to 1,000 acres each. The fires were burning out of control in steep, rugged terrain and heavy mixed timber, brush, and grass fuels. The burning conditions were extreme. Temperatures exceeded 100 °F. Relative humidity nighttime recovery ranged from 35 to 50 percent, and daytime relative humidity recordings were in the 10 to 18 percent range. Daytime winds were generally 12 to 20 miles per hour over the area. The 1,000-hour fuel moistures were the lowest on record. Local agency initial action forces were in place, mostly committed to protection of property.

The organizational structure expanded from a five-person unified area command staff to six large complexes, each under the command of a multibranch incident commander and team who directed all tactical operations. These six incident commanders contained, confined, and controlled 150 wildfires with 7,000 persons mobilized from 11 Federal agencies and 19 States. Operational units consisted of 177 handtool crews, 130 engines, 44 helicopters, 15 aircraft, initial attack smokejumpers, and a U.S. Air Force/Army National Guard contingent with 50 trucks, communications devices, and other support equipment. In addition, 500 persons and 150 pieces of equipment were recruited from the local area.

The incident commanders for the complexes were given responsibility and authority to conduct fire protection operations on all Federal and State lands within their respective complexes. This responsibility included direct action on all existing fires, the detection and initial action on new fires, and protection of life, property, and natural resource values.

The unified area command established strategic goals and policies for organizational structure, fiscal control and cost accounting, public affairs, communication and supply lines, distribution facilities, production priorities, supply priorities, and strength of force within the area. The logistics support system in place on the Wallowa-Whitman National Forest was expanded to meet the situation. Incident commanders for the complexes shared critical forces through direct transfer to meet the highest need. The complexity and magnitude of air operations required in-air coordination for three air groups during daylight operations.

Local agency officials and administrators participated in the unified area command and complexes as full partners. As a result, complete community resources were brought to bear on the critical situation. The local agencies were able to fulfill their responsibilities. They met every important community need, including essential services and emergency notification and evacuation. In addition, direct support was provided to the unified area command, opening local sources of supply and strengthening supply lines.

Of particular note is that the people in the community extended their personal resources to the command. One example: firefighters were provided with clean clothing during their assignment because community volunteers collected, washed, and returned personal clothing to them.

The incident commanders and their forces extinguished 150 wildfires, with 90,000 acres burned, without loss of life, serious injury, or damage to structures.

The Strategic Decision Model

The strategic decision model is composed of two distinct groupings of analytical factors that have a profound effect upon the outcome of any emergency situation. These two factors are best described as:

1. *Constant elements*—those elements of the emergency situation over which the area commander has little or no control.
2. *Variable elements*—those elements over which the area commander does have control.

Constant Elements. Constant elements outline the sideboards within which operations must be conducted if success is to be attained. Constant elements that affect emergency situations may be organized into four distinct groups:

- Environmental elements
- Social expectations
- Availability of forces and supplies
- Management values

The relationships among these four constant elements are displayed in figure 1. A successful strategic plan must outline policies that assure operations will be conducted within these constant constraints.

Constant elements must be identified and grouped for each area. Although some similarity may exist from one area to another, generalities should be avoided in favor of specific areawide analysis.

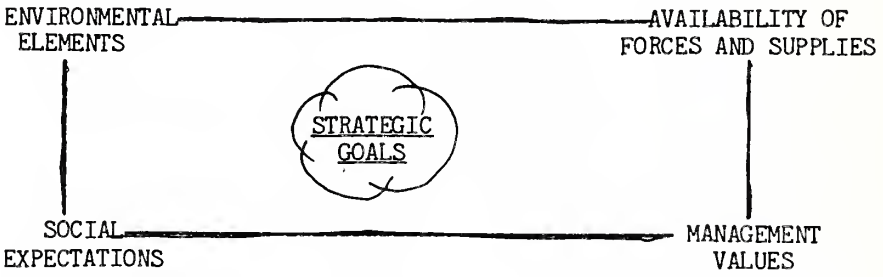

Figure 1—*Constant element analysis model.*

I. Environmental Elements

Environmental elements have a direct influence upon:

- Fire behavior, rates of spread, and intensity
- Number of individual incidents within the command area
- Access to points of attack
- Location of support facilities
- Strength of force and air operations
- Establish priorities for operations

Environmental elements include:

1. Values at risk
   a. Life
   b. Property
   c. Natural resources
2. Terrain
3. Fuels
4. Weather

II. Social Expectations

Social expectations vary with area demographics, community concern, and degree of involvement. The actions of those responsible for the overall management of an emergency operation may influence social expectations. Social expectations may be organized into the following elements:

1. Other involved agencies
   a. Do existing agreements have a relationship to the emergency?
   b. Are there unresolved issues that may relate to the current situation in a direct way?
2. Community leaders and public administrators
   a. What is their expectation for their continued performance withith the scope of their responsibility and authority?
   b. How will they be involved in critical changes in the situation?
3. Political expectations
   a. Do elected officials reflect constituent interests and concerns?
   b. What information is needed for officials to serve as important communication links to interest groups within the community?
4. Individual citizens within the community
   a. Is there a distinct and unique need for information?

b. Do any feel a need to volunteer information and/or participate in a meaningful way to bring the situation to a successful conclusion?

5. Economic needs within the community
   a. Are special skills and knowledge available?
   b. What is the availability of labor, supplies, and specialized equipment?
6. Safety, health, and welfare of the community
   a. What are the effects from depletion of local supplies, labor, and equipment?
   b. What are the effects from utilization of local emergency/medical response units and facilities?
   c. What is the capacity of local sanitation facilities?
   d. Are there issues generated by the community that are outside the scope of the emergency?

III. Availability of Forces and Supplies

The type and kind of forces, strength of force, and supply availability is usually dependent upon the priorities at all levels within the agency.

1. Supply lines—Availability of supplies and supply lines may limit the commitment of forces to those who can be supported in the field. An unsupported force intensifies adversity and complexity that must be resolved before success is attained.
2. Communications lines—Available communications hardware and lines of communication may be limiting factors in regard to communications within the area, between complexes, and for conducting operations. The area command post must have external communications. This is an essential area command requirement.

IV. Management Values

Management values may vary widely among complexes, involved agencies, and the public sector. Management values are grouped into four elements:

1. Line officer's direction
   a. Delegation of authority given to area commander
   b. Objectives set for the emergency—what will success look like?
   c. Values at risk—priorities and cost of operations
   d. Policy
   e. Regulation
2. Other agency values—May be similar to line officer direction given to all incident commanders when a unified area command is formed.
3. Public values
   a. Public concern for values at risk
   b. Safety, health, and welfare of community at large
   c. Scope of operations conducted within the area

Variable Elements. Given the constraints placed on operations outlined in the constant element analysis, area command must go to work with the many variables over which it does have control to construct strategic policies.

The relationship between the constant element analysis and the variable element analysis is shown in figure 2.

Strategic policies, as shown within the strategic decision model, need careful attention from the area commander and staff.

Strategic policies are generally required for:

1. Organizational structure
2. Organizational behavior
3. Fiscal control and cost accounting
4. Public affairs
5. Communications, supply lines, and distribution facilities
6. Production priority
7. Supply priority
8. Strength of force

Preparation of the Strategic Plan

After completing the analysis, the area commander and staff must prepare short- and long-term strategic plans for the area, including a full set of integrated strategic policies.

The emergency nature of the situation requires that an initial strategic plan be produced quickly, within a few hours. It must be done well to be effective.

A strong strategic plan should include:

- A summary of critical elements of analysis upon which the plan rests.
- An overall statement of both short- and long-term strategic goals.

- A clear summary of the operations to be conducted now and in the future.
- A description of how the command sees itself positioned relative to the conduct of operations and how it plans to differentiate itself from barriers to success now and in the future.
- An identification of key factors for success such as quality of strategic policies, financed controls, public affairs, and performance that must be monitored to accomplish strategic goals.
- An outline of strategic policies that must be carefully integrated to assure success.
- The identification of barriers that could prevent achievement of strategic goals and contingency plans to overcome those obstacles should they arise.

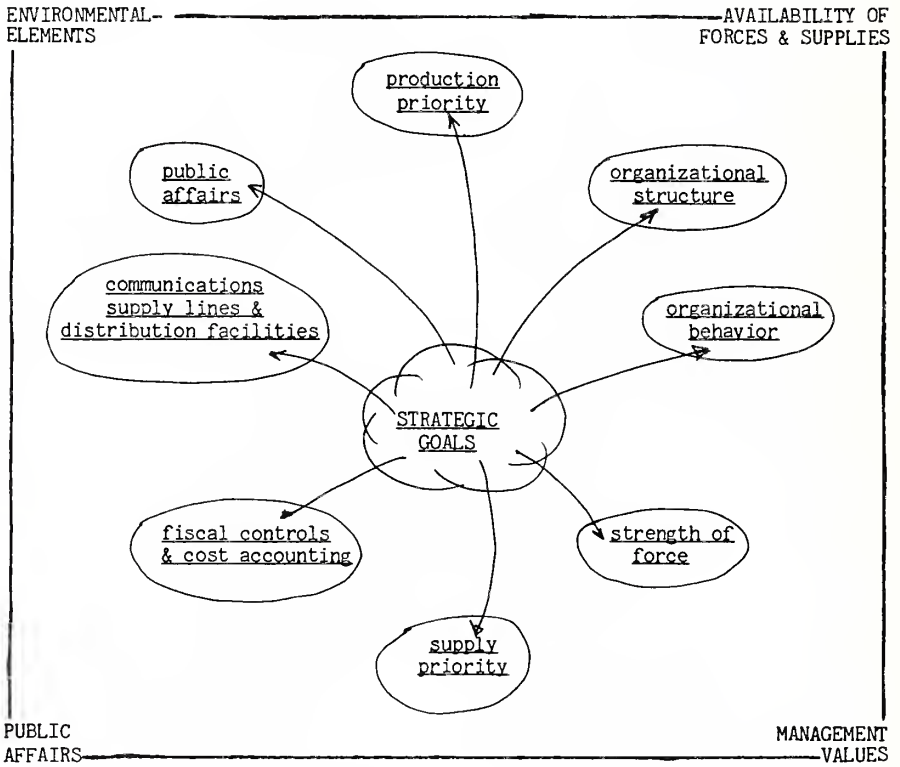

Figure 2—*Variable element analysis model.*

Each complex incident commander should be recognized as an individual with a unique management style and tactical approaches that are creative and resourceful. A good strategic policy will permit sound operations and good judgment on the part of all persons within the area.

Looking beyond today and trying to predict how successful the future will be is essential:

What will success look like—the end state of affairs?

What should be produced at what cost?

Where should the operation be undertaken?

What is the best way to implement strategy, given the unique position of the area?

Factors To Consider

Social expectations:

1. Are jobs needed in the community?
2. How dependent is the community upon local purchases?
3. What will anger the community?
4. How important is public opinion?
5. What is the effect of especially bad public opinion?
6. Will performance be affected?

Area command values system:

1. In what direction will the area command values system lead the organization?
2. What directions are prohibited by values?
3. What does area command most value?
4. Is the work environment important?
5. Will success be affected?

Agency barriers:

1. Regulations?
2. Cost requirements?
3. Policies?

Economic advantage—can an economic advantage be gained by:

1. Becoming larger?
2. Producing more?
3. Reducing number of facilities?
4. Reducing organizational structure?
5. Lowering unit costs?

Effective and resourceful leadership:

1. What are the experience and knowledge of commanders and staff?
2. Can the commanders contribute clever strategy and resourceful ideas to the operations within the overall area command?

Effective distribution system and facilities:

1. Are options so narrow as to reduce sources of supply and lengthen supply lines?
2. Will wide options increase the source of supply available to the command and shorten and strengthen both supply and communications lines?

Distribution of forces within the area:

1. Does strength of force exceed production requirements?
2. Are the complex work loads balanced and matched to an appropriate level of force?
3. Can forces be redistributed quickly?

Cooperation within the command:

Is the level of competition and rivalry in the command or between complex commanders intense?

Technology:

1. Type and kind?
2. Suitability for use within area?
3. Changes required in organizational structure to effectively manage the technology?
4. Logistical support and facilities required?
5. Cost-benefit derived?

Implementation of the Strategic Plan

Setting strategic goals and policies is valuable only if they are clearly communicated and implemented and the desired level of performance is attained.

If performance does not measure up to expectations, area command must be careful to identify the problems before making changes. Lower-than-expected results could be caused by:

- Miscalculation of variable elements when making strategic policy.
- A change in constant elements.
- A change in prospects for accomplishment.
- A change in conditions for the entire command.

Strategy and policies cannot be expected to be perfect in the initial strategic plan. Optimal strategies and policies evolve over the time of operations, as the area command grows and matures, and as the complex commanders experiment with and refine their operations. Area command staff must work hard to obtain good ongoing strategic assessments from the complex commanders and staff at least daily (fig. 3).

Figure 3—*Developing and implementing strategic goals and policies is an ongoing process.*

Strategic Policy Evaluation Checklist

- Can the overall policy be summarized in one or two sentences?
- Given a brief analysis of current conditions, does the current strategic policy seem to be optimum in light of operational strengths and weaknesses and environment?
- Does the current strategic policy effectively anticipate possible short-term and long-term changes in the situation?
- Has the strategic policy been effectively communicated to all levels of personnel in the complex? Are the majority of staff and managers in agreement with the long-term goals and objectives?
- Have policies been put in place within the various functional areas of the complex?
- Does the complex have people with the necessary vision developing and implementing strategic policies on an ongoing basis?

Summary

The strategic decision model provides an effective way for area commanders to analyze critical elements, both constant and variable, that have a profound effect upon the outcome of an emergency situation. The development of the strongest possible strategic policies is the area commander's most difficult responsibility and highest priority.

The critical element of implementing strategic policies: getting people to act in a manner that yields desired results. Strong complex incident commanders maintain strong organizations that have the capacity to implement strategic policies successfully. They implement change successfully when necessary to meet changing elements, both constant and variable. They are resourceful and effective.

Careful attention to organizational behavior issues is important. Incident commanders and the command staff must:

1. Be involved in the decision-making process.
2. Have personal job satisfaction.
3. Clearly support and communicate strategic goals and policies to others.
4. Translate strategic policies into highly effective operations and performance.

The strategic decision model is a way for area commanders to meet their strategic responsibilities. The model recognizes no single, proper way to do things. Perception, imagination, and flexibility are essential for success—judgment is the key. ■

A Valuable Fire Program

Federal excess personal property has been loaned to State forestry agencies since 1956 for use in wildland and rural fire protection. Under this program certain State officials are designated as Federal agents to screen property, provide receipt for property, and otherwise manage this Forest Service property that is on loan to them. In fiscal year 1986 Federal property originally costing the Federal Government over $30 million was loaned to State forestry agencies. This program has proven to be a popular and valuable one and should benefit wildland and rural residents for years to come.

Forest Service plane on loan to Alaska Division of Forestry through FEPP program. The plane is used for reconnaissance, fire mapping, infrared detection, and air attack.

Managing Confinement Suppression Response on the Middle Ridge and Little Granite Fires, August 1986

Francis Mohr, Dave Lukens, and Dorothy Terry
Respectively, assistant fire management officer, Wallowa Zone fire management officer, and incident information officer, Wallowa-Whitman National Forest, Baker, OR, and Enterprise, OR

During the multiple fire situation of August 1986 in northeast Oregon, a decision was made by the Wallowa Unified Area Command and respective line managers to designate "confinement strategy" as appropriate suppression response for two wildfires located in the wilderness on the Idaho side of the Hells Canyon National Recreation Area (HCNRA). A team of fire behavior analysts (FBA), an information specialist, and the assistant manager from the HCNRA was assembled Sunday, August 17, to assess fire behavior potential and make long-range predictions of fire perimeter and size for the Little Granite and Middle Ridge Fires (fig. 1).

Specific objectives for this team were to:

1. Develop a public information/involvement package ready for presentation by Tuesday morning, complete with maps, projected fire perimeters and sizes, supporting data, contingency plan, and an outline of major concerns.

2. Determine when and where these fires would threaten to spread beyond the wilderness boundaries.

3. Work with the Incident Command Team (ICT) in developing and updating the escaped fire situation analysis for each fire, while focusing on the least-cost alternative that was commensurate with land management objectives.

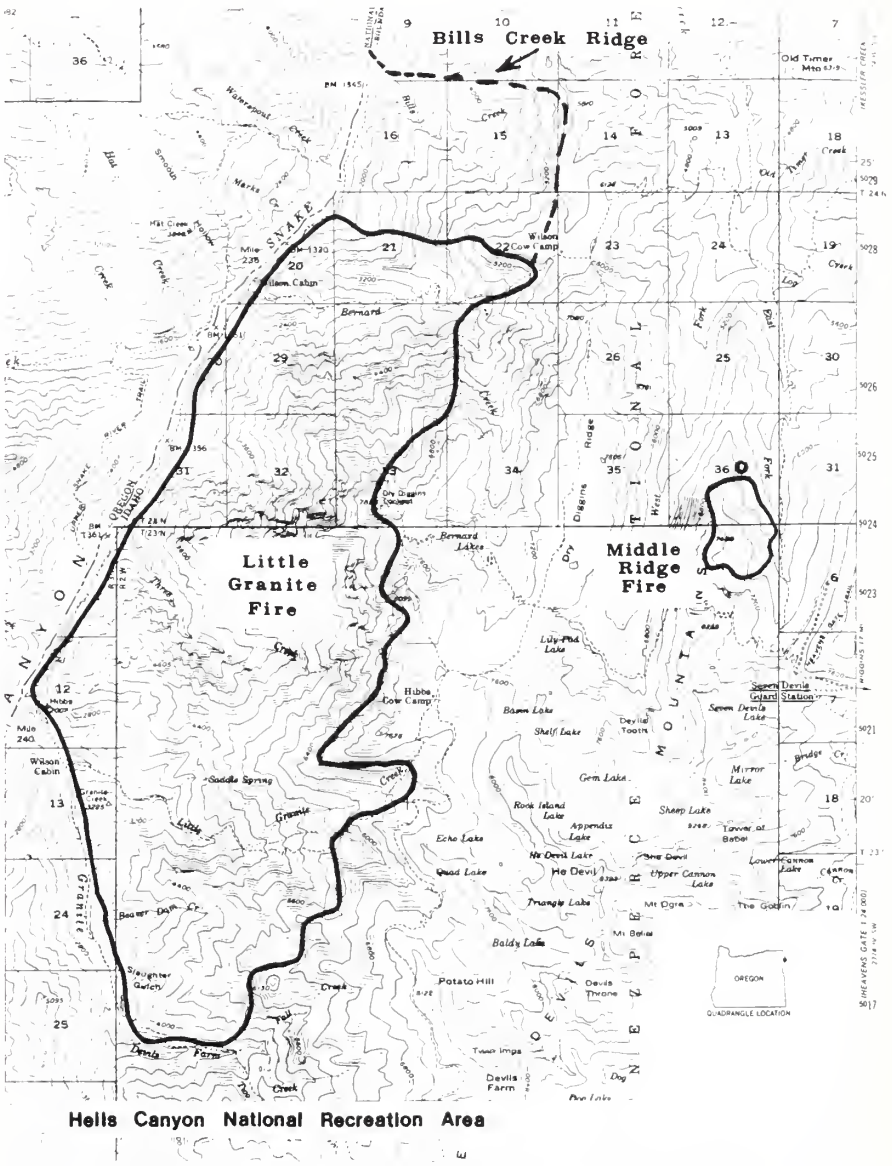

Figure 1—*Map of the Little Granite and Middle Ridge Fires in the Hells Canyon National Recreation Area.*

Fire behavior predictions were made utilizing the latest state-of-the-art fire modeling knowledge and concepts as incorporated in the BEHAVE Program. A worst case

[1]Team participants were: Byron Bonney, district fire management officer and FBA, Helena National Forest, Lincoln, MT; John Krebs, district fire management officer and FBA, Clearwater National Forest, Potlatch, ID; Greg Thayer, incident information officer, Wenatchee National Forest, Leavenworth, WA; Art Seamans, assistant manager, HCNRA, Lewiston, ID; and Francis Mohr, FBA, Wallowa-Whitman National Forest, Baker, OR.

scenario was analyzed using NFDRS historical weather from August 1967. This weather data was combined with meteorologists' forecasts to make long-term fire behavior projections. (Similar techniques had been used in 1985-86 on the Shasta and other fires in the Selway-Bitterroot Wilderness, Nezperce National Forest, ID.)

Fuel model 2 (open ponderosa pine stand with annual grass understory) was selected as representative of the Little Granite Fire area. Forward fire spread rates were reduced by half due to the rock outcroppings. On the other hand, a backing fire rate-of-spread was doubled because rolling burning material could travel very swiftly on the sparse fuelbed and spread rapidly upslope.

The majority of the Middle Ridge Fire was judged to be fuel model 10 (mixed conifer stand with dead, downed woody fuels). Model 8 was chosen for the 60- to 80-year-old lodgepole pine stand in the area north and east of this fire (fig. 2).

Winds at higher elevations were projected to be mostly light westerly as a result of upslope, updrainage airflow from the river canyon. Winds in the lower portion of the canyon near the river were projected to be from the north, corresponding to historic wind occurrence in Hells Canyon. Projections of daily fire spread were for a 3-hour period (1500-1800).

It was decided that a brief narrative explaining fire behavior and advancement along the various projection points would be compiled.

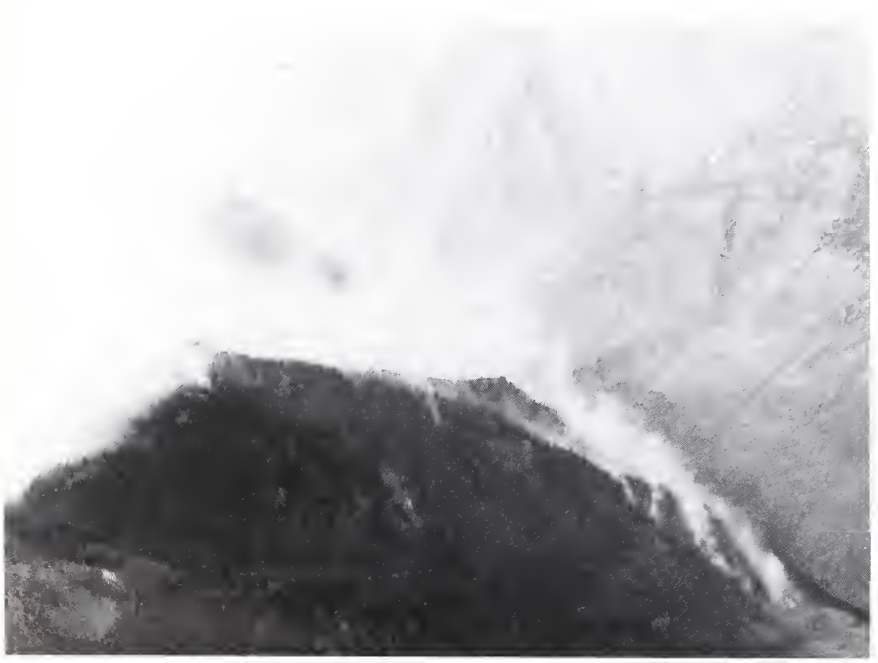

Figure 2—*Middle Ridge Fire.*

Any new fire starts within the area that exhibited significant fire spread would also be modeled.

Verification of predicted versus actual fire spread was conducted and adjustments made accordingly. Based on these projections and a predicted major weather change in winds, the FBA team reviewed a suppression strategy change with the ICT on Wednesday, August 20, for both Little Granite and Middle Ridge Fires.

Little Granite: Plans were made for four crews to start the next day on Bill's Creek Ridge, located downriver 2 miles from the existing fire front. This ridge was chosen as the most appropriate strategic point from which to build line and burn out. Aerial support from helicopters with water buckets would also be available.

Middle Ridge: A 20-person crew from the Nezperce National Forest was dispatched immediately to the Seven Devils Guard Station area in the event spread from the Middle Ridge Fire were to threaten these administrative structures and the wilderness boundary.

During the morning hours of Thursday, August 21, light rain fell over both fire areas, making the proposed plan to halt fire spread at Bill's Ridge unnecessary. The crew at Seven Devils returned to home station. Further suppression action included continued daily surveillance and some limited action to protect bridges and known historic cabin sites.

Onsite evaluation and documenting were performed on both fires by the FBA team, verifying fuel condi-

tions and effects that resulted from various observed fire behavior during the life of these two fires. The final fire size for Little Granite was 12,020 acres; for Middle Ridge, 1,251 acres.

Conclusions

The process provided worthwhile supporting rationale for the decisions made in managing these confinement fires and helped reinforce both public and employee acceptance that the decisions were sound, that they were based on the latest state-of-the-art methodology, and that confinement was the most cost-effective approach. In the end, approximately $200,000 was spent on Little Granite as compared to $2.4 million for Pumpkin Fire, a fire of similar size in the HCNRA with similar resource values where the suppression strategy was "full control." Additional benefits from the decision to use confinement strategy included: lessening firefighters' exposure to safety hazards, least-cost method commensurate with land management objectives and values, and minimal suppression/mop-up impacts, i.e., "light-hand-on-the-land" (fig. 3).

Long-term (from 2 to 30 days) fire behavior predictions are not yet an exact science, even though state-of-the-art techniques are being used. *However, there is an increasing need to use these techniques and make these types of fire projections as we enter an era of managing fire "with" time as opposed to "against" time.*

Figure 3—*The use of a confinement strategy resulted in minimal suppression and mop-up impact on the land.*

In summary, the process used on the Little Granite and Middle Ridge fires proved to be a practical and valuable means for managing fires, whether for an ongoing prescription fire or future wildfires, especially when appropriate suppression is less than all-out control. ■

An expanded description and photographs representing fuel conditions on the Little Granite and Middle Ridge fire sites are available from the Wallowa-Whitman National Forest supervisor's office P.O. Box 907, Baker, OR 97814.

An Alternative to Jeeps

Patrick E. Meckley

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In the late 1960's, a significant number of ¼-ton jeeps were purchased and turned into fire suppression vehicles. Due to increased urbanization, reduced budgets, and the need for versatility, we recently elected to replace the CJ5's and CJ7's with ¼-ton 4x4 Ford Rangers (fig. 1).

The last two fire seasons have shown our decision to be a wise one. Although it lacks some maneuverability, the Ranger has several advantages over the CJ5 and CJ7. First and most importantly the improved stability makes this vehicle much safer for high-speed driving. With proper placement of the tank and reel and tool boxes each unit can carry a full complement of fire suppression hand tools far superior to that which the jeeps afforded. In addition to far superior gas mileage, this unit, when not in fire season, can have the slip-on pumper unit removed. This luxury provides for improved vehicle versatility.

To perform as an effective fire suppression vehicle for wildfire suppression several additions were made to a 4x4 Ford Ranger. An electric winch and brush guard were added to the front of the vehicle. A 57-gallon tank and Panama pump were installed. A side box for fire tools was added to the rear of the truck bed (fig. 2), and an electronic siren and speaker were installed.

These additions, plus a full tank of water and one person, raised the GWR weight from 4,130 pounds to 4,460 pounds. The front-end weight went from 1,940 to 2,140 pounds and the rear end from 2,190 to 2,320 pounds. This additional weight caused a problem with the front-end alignment. Two front-end shims were replaced, and larger tires were installed. The vehicle originally came with Firestone Radial ATX's P195/75R15 for mud and snow. These were changed to General Versa Tracs P215/75R15 for mud and snow. The consensus was to go with a wider but not considerably larger tire because of the decrease in power and pickup a larger tire would cause in a 4-cylinder vehicle.

The miles-per-gallon rating is an average of 23. A high octane gasoline is used to eliminate the rattle that is present when regular gas is used in trucks of this size. This vehicle has a very smooth ride and responds well to hard surface road traveling.

A ¾-inch BB Panama pump is mounted under the hood with an electrical clutch mounted inside the cab. To the right of the steering column is the switch box with one switch for the pump and one for the throttle. The pump is under the hood, making it more maintenance free. The tank can hold up to 57 gallons. The booster line is ¾-inch hose, 200 feet in length.

A "homemade" bumper with a winch mount and bumper guard purchased from Sears is mounted on the front of the vehicle. This X3 Superwinch with a maximum of 3,500 pounds has been used on several occasions for pulling out ¾-ton pickups without 4-wheel drive.

Installed inside the cab within easy reach of the driver is a Heathkit electronic siren model GD 1810. This kit has a PA system, wailer,

Figure 1—*Ford Ranger adapted for use as a fire suppression vehicle.*

Figure 2—*Rear view of adapted vehicle.*

yelper, hi-lo signal, and switch for outside radio reception. A Heathkit grill siren speaker model #GDA 18-2 is mounted behind the grill in front of the radiator. This is an improvement over the standard electronic sirens, more of an "attention getter" when responding to a fire.

Grill lights model #SA-S-17-840 are mounted on the brushguard, and on the roof visibar are two Federal twin-beam lights for emergency response. This visibar has little vibration and visibility is high with the two sets of lights. Mounted on the rear in front of the tailgate is a Rawson tool chest model M-48. This chest holds four fire rakes, a brush hook, sledgehammer, bolt cutters, pulaski tool, chainsaw, box for small tools, and two hardhats.

Overall, these many improvements have made this ¼-ton 4x4 Ranger pickup an effective fire patrol vehicle. Two vehicles have been adapted for fire suppression work at the Madonna Forest Fire Equipment Development Work Center in Harford County, MD, and acquisition and adaptation of additional vehicles is planned. These vehicles are especially well suited to use in the Piedmont area of the State, an area of gently rolling hills that separates the Coastal Plain from the Appalachian Plateau. ■

The National Advanced Resource Technology Center

Kenneth Dittmer

Director, National Advanced Resource Technology Center, Marana, AZ

The National Advanced Resource Technology Center (NARTC) located in Marana, AZ, is a national training facility primarily funded by the USDA Forest Service, with supporting funds provided by U.S. Department of the Interior agencies. The facility's staff develops, supports, and conducts national and international technology transfer courses in the fields of fire and aviation management. They also present other training programs concerning minerals, lands, air quality, and pesticide management.

There is a standing curriculum of 22 national interagency courses with 12 courses offered annually. In addition, an international Spanish firefighting course is sponsored by the Forest Service and the Agency for International Development. In all, about 800 students receive certificates of completion each year. Students represent the Forest Service, Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs, State forestry agencies, university faculty, private industry, and several foreign governments. Convenient year-round access to the Center, comfortable onsite room and board, and the opportunity to learn without distraction provide the students with a very rewarding experience.

NARTC has evolved into a multifaceted center since its origination. Not only is it interagency in makeup and interdisciplinary in curriculum, it has a major role in development, support, and handoff of training programs at all levels. Its reliance on outside subject matter experts as faculty allows it to maintain a lean, efficient organization. Recently added is a computer-based classroom using the Forest Service Data General system. The training center has the capability to produce a full variety of color visual aids using computer-generated graphics. This new technology is

opening up new opportunities to provide excellence in training. NARTC is truly one of the most advanced and capable training centers in the Federal Government. ■

Slide/tape on FEPP

A slide/tape program on the Federal Excess Personal Property (FEPP) program has been distributed to Forest Service regional and area offices. The slide/tape explains the Forest Service authority to loan Federal property to State forestry agencies for fire protection. It is designed to provide orientation for State personnel, Forest Service personnel, and fire department/district personnel. The program is about 20 minutes long. State and National Forest personnel should contact the person with Cooperative Fire responsibilities in the Forest Service regional or area office. Fire district personnel should contact their State forestry office.

NATIONAL ADVANCED RESOURCE TECHNOLOGY CENTER FY88 Course Schedule

COURSE & DATE
I-520 ADVANCED INCIDENT MANAGEMENT **Date:** Feb. 1-12, 1988
I-620 AREA COMMAND **Date:** Feb. 4-12, 1988
FIRE MANAGEMENT FOR LINE OFFICERS **Date:** Feb. 22-26, 1988
THE ART OF FUEL MODELING **Date:** Mar. 28-Apr. 1, 1988
FIRE AND RESOURCE MANAGEMENT FOR LINE OFFICERS AND PROGRAM MANAGERS **Date:** Feb. 29-Mar. 11, 1988

The role of the National Advanced Resource Technology Center (NARTC), is to manage, develop, and conduct National technology transfer sessions in the fields of Fire and Aviation Management, Air Quality, Minerals Management, Lands Administration, and Pesticide Management. Interagency participation includes the design group, faculty, and student population.

NARTC also supplies state-of-the-art reference materials that are a result of, or part of, National sessions. This media may take the form of course books, field reference guides, slide-tape, or video-tape programs for limited distribution to state or regional level offices.

For additional information, contact Ken Dittmer, NARTC, Pinal Air Park, Marana, AZ 85653. FTS 762-6414; (602) 629-6414 (DG: NARTC: W06A)

Prescribed Fire in the Southeast—Five Steps to a Successful Burn

James Lunsford

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History and Background

The use of prescribed fire in the Southeastern United States predates any type of formal records but can be traced to use by Native Americans and members of the cattle industry established by the first settlers from Europe (*3*). The Southeast was settled primarily by people of a pastoral background from Scotland, Wales, Ireland, England, and Spain. These cattle herders made up 75 percent of the white population of the time (*5*). The use of fire to maintain grazing land for cattle was brought from the home countries, where its use continues today. Open range in the Southeast was prevalent, lasting officially until 1949 when Florida enacted closure of the last open range. However, lack of enforcement extended open range into the 1950's.

Cattle grazing was carried out in the Appalachian Mountains in a manner similar to the coastal plains and was particularly favored on high ridges and mountain tops that could not be farmed. This use accounts for most of the "mountain bald" of the southern Appalachians today. Fire was used to maintain these mountain pastures and is currently used today to maintain these balds for their esthetic values.

The three physiographic regions of the Southeast, the coastal plains, the mountains, and the piedmont, have their own unique requirements for the use of prescribed fire. The pine forests of the coastal plains allow almost unlimited use of fire because of the natural resistance of the southern pine tree to damage by heat. However, the hardwoods of the mountains are damaged severely by fire and therefore its use is limited to openings, bald maintenance, and site preparation for planting commercial trees. The piedmont is made up of rolling hills and a mixture of hardwood and pines. The use of prescribed fire must be compatible with the vegetation occupying the site. Grasses and herbaceous plants are nurtured and respond favorably to fire whereas small hardwoods will be top killed and some will eventually be eliminated. Live tissue has a tolerance of heat to about 145 °F, but lesser temperatures will kill live tissue if exposed for a long period of time. Southern yellow pine trees have thick, insulating bark that provides protection, and a damaging level of heat is seldom reached, especially on large trees. For all species, the larger the tree, the more heat it can resist. The tolerance of heat is much less for hardwoods and for other pine and fir species.

Let me borrow a paragraph from "Fire in America" by Stephen Pyne to help set the stage for the use of fire.

> A *fire environment* consists of the fuels, topography, and weather within which a fire burns. When a fire environment combines with a consistent pattern of ignition, then a *fire regime* results, characterized by a particular vegetative ensemble and regular pattern of fire behavior. Such vegetative ensembles are often referred to as *cover types* or *fuel types* and to transform vegetation deliberately from one cover type to another is known as *type conversion.* When, because of its fire pattern, a fire regime maintains a certain type of vegetation cover that, in the absence of fire would give way to other cover types, then that biota is referred to as a *fire climax* and the particular vegetation as a *fire type*...When a consistent pattern of reburning is established, the outcome is a *fire cycle*...Controlled fire that is introduced under a predetermined set of conditions (prescription) is referred to as a *prescribed fire* (*6*).

The evolution of prescribed fire in the South transcends the cattle industry, the agricultural industry, and, later, the timber cutting that eliminated most of the commercial forests. After the timber harvest that peaked in 1900, the use of fire continued and thus prevented any reforestation and the land became a timber desert. Fire was declared illegal and fire prevention was the thrust to protect the new forest. Because of the mosaic that existed across the South, game (quail and turkey) became plentiful and game management became profitable. Many "hunting plantations" developed that catered to the rich "Yankee tourist" and others who could afford to participate. This economic windfall was short lived, however, as the population of wildlife began to decline.

Paper presented at a workshop for forest managers, Peru, VT, May 7-8, 1987.

Hunting plantation owners banded together to find the cause for the decline. Herbert Stoddard was commissioned to study the problem in 1924. Seven years later, he published "The Bobwhite Quail, Its Habitat, Preservation, and Increase." He concluded that quail populations depend on land management practices and that "fire may well be the most important single factor in determining what animals or vegetable life will thrive in many areas" (*8*). Evidence began to mount that the growth of "rough" contributed to damage caused by wildfire and that the use of prescribed fire could reduce this damage by reducing the amount of fuel under less severe conditions than may exist when a wildfire occurs. Thus, "wood burning" has come full circle and is now practiced by most land management agencies.

The Five-Step Method

"A Guide for Prescribed Fire in Southern Forests" (*4*) suggests a five-step method for a successful prescribed fire. I plan to describe this procedure as carried out by the USDA Forest Service in the Southern Region (Region 8).

Analysis. An inventory of all National Forest land in the South is conducted on a 10-year rotation. During this inventory, as much information as possible is gathered about each stand and forest type. Each ranger district is subdivided into compartments of about 1,000 acres each. Each compartment is broken down into stands of 10 to 80 acres each, depending on the vegetative type. The maximum size of a regeneration cut (usually a clear cut) is dictated by law in the Forest and Rangeland Planning Act of 1974. The act limits clear cuts in the pine type to 80 acres and 40 acres in the hardwood type; however, the average is much less (about 30 acres). Ten acres is a minimum because any smaller area is more difficult to manage and inventory. Smaller areas, however, are mapped as inclusions in larger stands as wildlife openings or food plots referred to as key areas. Riparian areas (streamside zones) are also mapped. A detailed description is made of all stands and inclusions. During this inventory process, a thorough analysis is made of each stand to determine needs and what actions should be taken to meet those needs. Many alternatives to fire that provide acceptable effects are mowing, herbicide, and mechanical treatments. Generally, fire is the most economical or has fewer side effects, but its use is limited because of the risk from smoke.

Grazing. Improving grazing is one of the oldest uses of prescribed fire and at one time the most extensive. Mowing can produce a similar effect to fire on the grass area provided machinery can be used. However, mowing leaves the "thatch" and mowing residue (waste). Waste has a detrimental effect on most plant life (*3*). Fire has the effect of removing both the excess growth and the old thatch.

Wildlife Habitat Improvement. Prescribed fire applied when the plants are dormant, generally only

The hand-held drip torch is the most frequently used source of ignition for prescribed burning in the South.

top kills the species that are desirable by wildlife, i.e., the plants will sprout again, providing the browse needed for wildlife. However, summer burns tend to root kill and eliminate most hardwood species and many forbs. A low intensity fire that does not burn deeply into the duff is desirable. This type of fire will cause sprouting and kill fewer plants.

Timber Management. Fire is used for site preparation and to remove undesirable competition. The site prep burn is applied in the summer if possible and a hot fire is desired to kill as much competing vegetation as possible. A fire to reduce the undesirable competition is first applied during the dormant season when the pine overstory is about 3 inches in diameter at the ground. Fire is applied on a 3- to 5-year cycle and is applied in the summer when the trees are 6 to 8 inches in diameter. This technique will pro-

duce almost a pure stand of pine and less competition for reforestation after harvest time.

Fire Protection. A pine plantation is most vulnerable to fire when the trees are young and have the normal grass and small plants associated with young pines. A cool prescribed fire applied as soon as possible, usually when the trees are 2 to 3 inches in diameter at the ground, will fire proof the plantation for about 3 years. Even then, a heading wildfire will cause considerable damage. Fire prevention is still necessary. A rotation of fuels reduction burning must be carried out on a 3- to 5-year cycle.

Esthetics. In areas of high visitor use, the concern is to keep down the understory and provide a pleasing view. Flowering plants and shrubs respond differently to fire applied at different times of the year. If fire is applied after flower buds are set in late summer, the bud will be killed and there will be no flowers the next spring. Timing is critical when fire has such an effect. Maintenance of openings and mountain balds is accomplished with fire. Herbicide use following a fire will help convert the area to grass, if desired.

Disease Control. Longleaf pines are infected with brown spot blight *(Scirrhia acicola)* when they are in the grass stage, about 1 to 3 years old. Prescribed fire is used to burn off the infected needles and kill the blight. However, this applies only to the current crop of trees; the next crop will again need the same treatment. *Armillaria mellea* (root rot) is thought to be reduced by prescribed fire.

Rare and Endangered Species. Prescribed fire is used to maintain the habitat of several rare plants and animals. The red-cockaded woodpecker requires a certain vegetative condition that is perpetuated by the use of fire. Rare plants such as mountain golden heather *(Hudsonia montana)* and pitcher plant *(Sarricia* Sp.) can be perpetuated by fire.

Prescription. This is a complex document and probably the most important single ingredient in the prescribed fire process. Generally, the prescription refers to the environmental conditions affecting how a fire will behave in a given fuel bed. The prescription is only a single part of the *prescribed fire plan.* The prescription is usually written as open as possible to take advantage of the few days that are favorable for burning. In the Southeast, there are generally about 22 to 28 days that are considered suitable for burning in the fall and winter months. Some burning is done in the summertime, which accounts for additional days, but the amount of burning is limited because of the already high temperatures. Experience may lead to more summer burning because some very desirable effects can be accomplished during this time.

Because temperatures are critical (live tissue will be killed at about 145 °F, the prescription becomes very important. One of the most important elements in the prescription is fuel moisture. Fuel moisture is dependent on type of fuel, days since rain, and relative humidity. (Fuel moisture serves to dampen heat and the rate of fuel consumed and thusly limits, to a large degree, the amount of heat produced.) Wind speed plays the next critical role in fire behavior. The faster the wind blows, the faster and hotter the fire, provided the fuel moisture is low enough to allow combustion to take place.

Experience has shown that fire may be applied with a variety of combinations of fuel moisture and wind speed with varying results; however, combinations of low fuel moisture and high wind speeds generally cause unacceptable damage to overstory species. Firing techniques can be used to control heat in many cases. Here the experience of the burner must be applied. Large-scale weather patterns must be observed to keep abreast of wind changes and approaching storm centers.

Prescription writers—the prescribed fire planners—should be the most qualified persons available. Their qualifications must include both actual experience and access to research data and training by other disciplines, such as wildlife biology, silviculture, etc. The prescription (prescribed fire plan) must include all the elements to be considered before, during, and after the burn; a simple, short form will not suffice for this documentation.

Smoke from the fire, a seemingly harmless element, has become as important and as potentially dangerous as the fire itself. Recently, several people have been killed as a result of smoke blocking visibility on major highways. Lawsuits in the millions of dollars have resulted

against the companies responsible for the prescribed fire, and some States have proposed legislation to eliminate the use of fire as a management tool in the forest. Fortunately, no laws have passed that would severely limit management of southern pine forests and other habitat improvements.

Data and guidelines have been developed to allow the user of prescribed fire to manage smoke. Areas that are affected by smoke, such as highways, hospitals, and airports, should be identified. A wind direction is chosen that will blow the smoke away from the smoke sensitive area. Other efforts include mitigating measures such as closing roads.

Preparation. Another seemingly simple process becomes critical when one takes into account the damage caused by the use of a plow to construct a fire line. Soil erosion may become a problem or the visual effect of the plowed line may be unacceptable. Many techniques are employed. For instance, in sensitive areas, hand lines are constructed, and the use of a *water expansion system* (foam) is used in some cases. Regardless of the system employed, the line must be capable of holding the fire. The type of fire used, (backing fire, slow ignition, etc.) should be considered. Natural barriers, such as river, bays, and roads, can also be used to lessen the impact on the environment. When access is available, the fire may be controlled by water pumping equipment. Other equipment used in fire line construction includes the mist blower, which works best in hardwood leaves. Blasting (Primacord) has been used but is not readily available and requires highly qualified personnel to use. Lines are constructed when only a backing fire is to be used—lines are plowed at approximately 10-chain intervals perpendicular to the wind direction. Firing is done from each line to maintain a low-intensity backing fire.

Lines should be constructed at some time prior to the planned burn, but not so early that leaf and needle fall will fill the lines. If the lines do become filled, a mist blower can be used to again open up the lines. The burn plan should contain a map that depicts the locations of all fire lines and how they are to be constructed. Cross drainage ditches should be incorporated at the time of construction to prevent erosion.

Preparation also includes gathering weather data. Weather station equipment can be located on the burn site to determine rainfall, relative humidity, wind speed, and fuel moisture.

Execution. The time to ignite the fire has finally arrived but that may be obvious only to a few experienced individuals. The time to burn is when the weather is favorable—"in prescription"—and a weather forecast predicts that conditions will remain favorable during the time of the burn. The wind direction must be correct to prevent smoke from affecting smoke sensitive areas, and the atmosphere must be capable of dispersing the smoke. The firing technique and firing device were previously listed in the burning plan; the necessary equipment must also be ready. If aerial ignition is planned, the extensive organization required must be put together prior to ignition time. Communications must be established with all participants. Assuming that all the logistical problems have been solved a test fire should be conducted to confirm that all the planning and predictions are in fact true. If the test fire does not indicate that the fire will achieve the objectives of the plan, the fire must be extinguished. Generally, an area has been previously set up for the test fire or at this time a fire plow or water equipment will be needed to extinguish the fire.

Once the decision to burn is made, then the preplanned ignition pattern is executed, i.e., backing fire, strip-head fire, or spot fire, as the case may be. Ignition is primarily done with the hand-held drip torch. More use is being made of aerial ignition in the past few years. The helitorch and the Ping-Pong ball machine offer the capability to burn areas inaccessible or unsafe for foot travel and can burn large areas in a short time. The best rate of burning to date is 3000+ acres in 1 hour on the Kisatchie National Forest in Louisiana. Normal operations, however, are about 3,000 to 4,000 acres per day for underburning and 300 to 400 acres per day for site preparation. Many variables are involved in burning, and experience is needed in each area to know what to expect.

The helitorch, which requires the mixing of gasoline and Alumagel or Sure-Fire, a thickener, requires 2 to

4 persons to work around the heliport. This expense, plus the risk of fire or explosion, has given us good reason to use the Ping-Pong ball machine. This machine reduces the risk and the number of people involved. Only one person is needed to operate the machine with no exposure to flammable materials. The machine injects the plastic ball, which contains potassium permanganate, with ethylene glycol and then ejects the ball from the helicopter. The balls ignite after reaching the forest floor, causing a spot fire. Results of all types of ignition are similar and the decision to choose one over the other depends on needs, availability, type of fuels, and terrain involved. Aerial ignition will permit more heat to be generated and is used when high fuel moisture conditions exist. The helitorch can be used when moisture is too high for other ignition sources to be used.

The firing pattern will have a great deal of influence on the results of the burn. Strip-head fire is the most commonly used when firing with the handheld drip torch and the helitorch. This technique is used for underburning when the overstory is large enough (6 to 8 inches or larger) to withstand considerable heat. The backing fire, generally, must be used for plantation (2 to 3 inch) and poles (3 to 6 inch). Fuel loading will determine also the type of fire to use and also the effects of the fire. Heavy fuel loading, when an overstory exists, should not be planned to be consumed in a single burn. Several burns may be necessary to reduce the loading to a safe level. The Ping-Pong ball machine starts a series of spot fires spaced according to desired intensity. Spots closer together provide less intensity than spots at wide intervals (*2*).

The backing fire spreads at about 1 to 3 chains per hour in all fuels regardless of wind speed (*1*). When a backing fire is planned, fire lines must be plowed perpendicular to wind direction at intervals that will allow the burn to be accomplished in the specified time. A ring fire may be used for clearcut slash areas especially if danger exists to crews crossing the area. Most common is the use of the helitorch to ignite the slash unit as quickly as possible using the strip method. This represents an "area fire" and creates considerable heat with a large convection column. Again, some experience will be necessary to conduct a successful burn. Selection of the firing technique must consider the effects of the fire on all resources—soil, water, air quality, timber, wildlife, and so forth.

Evaluation. The evaluation should be a part of the original prescribed fire plan. The objectives of the burn should be defined so that they may be evaluated after the burn, both immediately and at some later date. Clearly defined objectives, of course, will make this job easier. An evaluation form should be attached to the burning plan with several items to be evaluated after the burn. Data on characteristics such as flame length and rate of spread must be gathered during the burn. Several items that should be evaluated are:

Weather parameters. Were they within prescribed guides during the burn? Data should be recorded during the burn to insure that unforeseen conditions do not cause resource damage or cause the fire to escape control.

Effects on vegetation. Did the fire accomplish the objectives set out in the prescription? Were trees killed or scorched beyond desirable levels? Was lesser vegetation consumed or killed as desired? Information should be related to weather parameters for future reference. An evaluation after the growing season will indicate effects not known at the time of burn, concerning sprouting and other conditions.

Effects on fuels. Did the fire consume the fuels as desired or was more or less consumed? Consumption will be related to fuel moisture, wind speed, and days since rain (drought conditions). Consumption of all fuel will expose mineral soil and could later lead to erosion problems.

Escape. Did the fire escape the control lines and why? What were conditions when escape occurred? Was line incorrectly located or constructed? A weather forecast prior to burn time should predict possible weather changes that may cause erratic fire behavior.

Effects on other resources. Was excessive mineral soil exposed? A later evaluation may indicate erosion problems, or other problems. Did the fire affect wildlife such as ground nesting birds? Were there smoke related incidences? Were smoke sensitive areas affected? We are responsible for our actions even though the effects may be subtle, such as aggravating one person's lung problems, dirtying the clean

laundry hanging outside, or depositing soot and ash on nearby cars.

Legal Responsibilities

Regulations pertaining to the use of fire differ in almost every State. Some States require permits to burn that are issued only when burning conditions are low. Some have a prohibition against burning when air quality standards will be violated. Some air quality regulations prohibit any kind of pollution that constitutes a "public nuisance." Some States require notification of adjacent landowners.

Two forms of liability must be addressed, criminal and civil. Criminal liability exists when a State law is violated, such as failing to acquire a burning permit. Violation of State law may be either a misdemeanor or felony. The basic difference is that a misdemeanor has a jail sentence of less than 1 year and a felony has a jail sentence of more than 1 year. Both are accompanied by a fine.

Civil liabilities exist when the fire causes personal injury or property damage. Damage could occur on adjacent land if the fire escapes, or the smoke could cause an accident at some distance from the fire. However, to be liable, a person must first be judged to have been negligent. Some State laws say negligence is not present if the burner has taken all the necessary precautions that a "prudent person" would have taken under the circumstances. Some state laws say a violation of the law constitutes negligence; thus, if the burners fail to acquire a burning permit, they are automatically negligent and responsible for any damage (*7*). The best defense against liability is to follow the law and the *prudent person* concept.

Conclusion

Fire in the southern forest transcends all records of man and is responsible for propagation of the southern pine forest ecosystem, especially the longleaf pine, which would probably pass from existence without its use. This species is referred to as a fire climax type. To perpetuate the pine type, fire can be applied by man but only under acceptable conditions. Because of the liabilities associated with fire, the user is responsible for acting in a prudent manner and not inflicting personal or property damage.

A five-step system is suggested to minimize the risk when using prescribed fire. An *inventory* of needs should be undertaken to determine the amount of burning needed and the compatibility with other resources. A detailed *plan* must be prepared to insure all necessary requirements are met. This plan must include labor and equipment needs, burning parameters, smoke management requirements, and an evaluation list. *Preparation* must be done in advance of the burn to insure completion prior to burn time and should be sufficiently permanent to last until the burn is completed. Prevention of erosion from plowed lines can be done when construction of line is completed. *Execution* of the burn will be in compliance with the plan or with approved changes. Ignition can be either handheld or aerial, as prescribed in the plan. An *evaluation* should be made immediately after the burn and also at some later date. The evaluation should determine if the objectives of the burn were met and if any corrections or adjustments should be made on future burns. We must be aware of our legal responsibilities in order to insure that we'll be able to continue to use prescribed fire as a management tool.

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